

SCIAMACHY far-red FLOURESCENCE README FILE

Overview

This document presents a brief description of the SCIA_F data products. These are experimental research products produced by PI Joanna Joiner on a best effort basis. SCIA_F version 26 (V26) retrievals from the SCIAMACHY instrument on ENVISAT use a far-red channel with ~ 0.5 nm spectral resolution and wavelengths between 734 and 758 nm (a smaller fitting window than that presented in Joiner *et al.*, 2013). Note that in this wavelength range SCIAMACHY data were spatially averaged on board to reduce downlink bandwidth. As a result, the pixels are 4X larger than those in the red band and somewhat less than 4X larger than GOME-2 pixels in the nominal observing mode. Therefore, there will be more cloud contamination and poorer spatial resolution than GOME-2 products. Because SCIAMACHY alternated between limb and nadir modes, the daily coverage has blocky pattern and monthly coverage will not be as good as that from GOME-2. The retrieval code used here is the same software version as that used to process v26 GOME-2 data. Other changes have been made to the algorithm since Joiner *et al.*, 2013 (see Joiner *et al.*, 2014, 2016). Contact the PI for more details.

Data Quality Assessment

SCIA_F products are inherently noisy due to low signal levels. Users should expect to see negative values in both level 2 and level 3 data sets. When using level 2 data sets, users should retain those negative values and treat them like they would for any other noisy data set. For example, if fluorescence is zero, there should be a distribution of measurements centered about zero including negative values. Any attempts to remove negative values or force them to zero for the purpose of averaging will then bias results. Level 3 data are monthly gridded averages, yet still there are some negative values owing to imperfect bias correction, noise,

etc. Users may treat the negative monthly values as zero for certain applications. However, in other applications, such as averaging over a number of years, the negative values should be retained.

Users should be aware that the SCIAMACHY data sets provided here have undergone only a limited amount of validation (e.g., Yang et al., 2015). Output of far-red retrievals has been compared with GOME-2 and some differences have been found. Biases are different as are the corrections made to mitigate these biases.

Known Algorithm Features:

- 1) Month to month (temporal) variations may incorporate instrumental and algorithmic effects.
- 2) The level 2 data have had various filtering applied. In particular, a screening for cloud contamination is applied (only data with effective cloud fractions of $<30\%$ have been retained). Due to the large SCIAMACHY ground footprint, clouds and aerosol are present in nearly every observation. Although our retrieval approach can tolerate moderate amounts of cloud contamination, clouds will screen the surface signal from satellite view. Therefore, temporal and spatial variations in the data may also be due to cloud contamination. The cloud filtering approach is described in Joiner *et al.* (2012). For a more complete description of the errors, please see Joiner *et al.* (2013). Users may wish to apply additional cloud screening using the cloud fraction data field depending upon their application.
- 3) Some issues with data at very high solar zenith angles (in winter at high latitudes) have been noted (fluorescence is slightly positive or negative when it is expected to be zero).
- 4) Level 3 data have had various filtering applied but include cloud-contaminated data (cloud fractions of up to 30% are included). Please check for updates as we expect to improve the gridding to

account for known sources of error.

- 5) There has been not attempt as of yet to reconcile the differences between SCIAMACHY and GOME-2 data sets. Users are advised to proceed with extreme caution if both data sets are used together. Analysis of both data sets is ongoing; the data are provided on an 'as is' best effort basis.
- 6) SIF values are sensitive to absolute calibration of the solar irradiances. No adjustments based on the solar data are applied to SCIAMACHY data as was done for GOME-2A.
- 7) SIF values are provided over ocean for monitoring of biases. We have attempted to correct for small zero-level offset problem in previous versions as noted by Köhler et al., 2015 with correction method discussed in Joiner et al., 2016. We now provide both the corrected and uncorrected SIF_740 data fields. As the bias correction is not perfect, small biases still remain, particularly over high albedo (high radiance), non-vegetated surfaces such as the Sahara desert.

Product Description

The SCIA_F level 2 product is written as a self-describing netCDF level 2 orbital file for the day and orbit specified in the filename. A simple IDL reader has been provided. The information provided on these files includes: Latitude, longitude, SIF (SIF_740) referenced to 740 nm, and reflectance near 670 and 780 nm.

The SCIA_F level 3 product is written as a self-describing netCDF level 3 monthly gridded file for the month and year specified in the filename. A simple IDL reader has been provided. The information provided on these files includes: Latitude, longitude, counts, SIF (SIF_740) referenced to 740 nm (mean and standard deviation), and NDVI derived from 670 and 780 nm (mean and standard deviation). Note that the NDVI is cloud contaminated and no attempt has been made to apply

atmospheric correction. This field is given for a rough reference and convenience only and it is not meant to be used for scientific investigations. The level 3 data sets contain only the corrected data.

Contact

All questions related to the SCIA_F datasets should be directed to Joanna Joiner (Joanna.Joiner@nasa.gov), the PI of this project. The PI requests to be contacted regarding studies that utilize the data provided on this website as these are relatively new data sets that have not undergone much validation and detailed knowledge of data issues may be important to the scientific use of these data. Regular updates to this README file will be posted based on user questions and feedback.

Acknowledgments

This work was originally funded in part by the NASA Carbon Cycle Science program (NNH10DA001N) and is now supported under the NASA US Earth Science Participating Investigator (USEPI) program. We gratefully acknowledge ESA for providing the SCIAMACHY data used here.

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